

CPC**COOPERATIVE PATENT CLASSIFICATION****F04B****POSITIVE DISPLACEMENT MACHINES FOR LIQUIDS; PUMPS**

(machines for liquids, or pumps, of rotary piston or oscillating piston type F04C; non-positive displacement pumps F04D; pumping of fluid by direct contact of another fluid or by using inertia of fluid to be pumped F04F; crankshafts, crossheads, connecting-rods F16C; flywheels F16F; gearings for interconverting rotary motion and reciprocating motion in general F16H; pistons, piston-rods, cylinders, in general F16J)

NOTE

In this subclass, the following term is used with the meaning indicated:

- "piston" also covers a plunger.

Attention is drawn to the notes preceding class F01, especially as regards the definitions of "machines", "pumps", and "positive-displacement".

WARNING

The following IPC groups are not used in the CPC scheme. Subject matter covered by these groups is classified in the following CPC groups:

[F04B 35/02](#) covered by [F04B 9/08](#)

Pumps for liquids or for liquid and elastic fluids; Positive-displacement machines for liquids (pumps for raising fluids from great depths [F04B 47/00](#); having flexible working members [F04B 43/00](#))

F04B 1/00

Multi-cylinder machines or pumps characterised by number or arrangements of cylinders ([F04B 3/00](#) takes precedence; fluid-driven pumps [F04B 9/08](#); control of reciprocating machines or pumps in general [F04B 49/00](#))

F04B 1/005

. {Pumps with cylinder axis arranged substantially tangentially to a circle centred on main shaft axis}

F04B 1/02

. having two cylinders (in V-arrangement [F04B 1/04](#))

F04B 1/04

. having cylinders in star- or fan-arrangement

F04B 1/0404

.. {Details, component parts specially adapted for such pumps}

F04B 1/0408

... {Pistons}

F04B 1/0413

... {Cams}

F04B 1/0417

.... {consisting of several cylindrical elements, e.g. rollers}

F04B 1/0421

... {Cylinders}

F04B 1/0426

... {Arrangements for pressing or connecting the pistons against the actuated cam}

F04B 1/043

.... {hydraulically}

F04B 1/0435

... {Disconnecting the pistons from the actuated cam (in general [F01B 31/24](#))}

F04B 1/0439	...	{Supporting and guiding means for the pistons}
F04B 1/0443	...	{Draining of the engine housing; arrangements dealing with leakage fluid}
F04B 1/0448	...	{Sealing, e.g. seals for shafts or housings (F04B 1/0408 , F04B 53/164 take precedence)}
F04B 1/0452	...	{Particularities relating to the distribution members (F04B 1/0472 , F04B 1/0531 and F04B 1/0535 take precedence)}
F04B 1/0456	.....	{to cylindrical distribution members}
F04B 1/0461	.....	{to conical distribution members}
F04B 1/0465	.....	{to plate-like distribution members}
F04B 1/047	..	with an actuating or actuated element at the outer ends of the cylinders
F04B 1/0472	...	{with cam-actuated distribution members}
F04B 1/0474	...	{with two or more series radial piston-cylinder units}
F04B 1/0476	.....	{directly located side-by-side}
F04B 1/0478	.....	{Coupling of several cylinder-barrels}
F04B 1/053	..	with an actuating or actuated element at the inner ends of the cylinders
F04B 1/0531	...	{with cam-actuated distribution members}
F04B 1/0533	.....	{each machine piston being provided with channels which are coacting with the cylinder and are used as a distribution member for another piston-cylinder unit}
F04B 1/0535	...	{the piston-driving cam being provided with an inlet and an outlet}
F04B 1/0536	...	{with two or more series radial piston-cylinder units}
F04B 1/0538	.....	{directly located side-by-side}
F04B 1/06	..	Control {(F04B 49/12 , F04B 49/18 take precedence)}
F04B 1/063	...	{by using a valve in a system with several pumping chambers wherein the flow-path through the chambers can be changed, e.g. series-parallel}
F04B 1/066	...	{by changing the phase relationship between the actuating cam and the distributing means}
F04B 1/07	...	by varying the relative eccentricity between two members, e.g. a cam and a drive shaft
F04B 1/08	...	regulated by delivery pressure
F04B 1/10	..	the cylinders being movable, e.g. rotary {(F04B 1/20 and F04B 3/006 take precedence)}
F04B 1/107	...	with an actuating or actuated element at the outer ends of the cylinders
F04B 1/1071	.....	{with rotary cylinder block}
F04B 1/1072	.....	{with cylinder block and actuating cam rotating together (F04B 1/1075 and F04B 1/1078 take precedence)}
F04B 1/1074	.....	{with two or more series radial piston-cylinder units}
F04B 1/1075	.....	{with cylinder block and actuating cam both rotating (F04B 1/1078 takes precedence)}
F04B 1/1077	.....	{directly located side-by-side}
F04B 1/1078	.....	{with cylinder block and actuating cam both rotating}
F04B 1/113	...	with an actuating or actuated element at the inner ends of the cylinders
F04B 1/1133	.....	{with rotary cylinder block}
F04B 1/1136	.....	{the rotary cylinder being provided with only one piston, reciprocating within the cylinder}

- F04B 1/12 . . . having cylinder axes coaxial with, or parallel or inclined to main shaft axis
- F04B 1/122 .. {Component parts, details, e.g. valves, sealing, lubrication ([F04B 1/2014](#) takes precedence)}
- F04B 1/124 ... {Pistons}
- F04B 1/126 {Piston shoe retaining means}
- F04B 1/128 .. {Driving means}
- F04B 1/14 .. {having stationary cylinders}
- F04B 1/141 ... {Component parts}
- F04B 1/143 {Cylinders}
- F04B 1/145 {Housings}
- F04B 1/146 {Swash plates or actuating elements}
- F04B 1/148 {Swash plate or actuating element bearing means or driving axis bearing means}
- F04B 1/16 ... having two or more sets of cylinders or pistons
- F04B 1/18 ... having self-acting distribution members, i.e. actuated by working fluid
- F04B 1/182 {Check valves}
- F04B 1/184 {Cylindrical distribution members}
- F04B 1/186 {Conical distribution members}
- F04B 1/188 {Plate-like distribution members}
- F04B 1/20 .. having rotary cylinder block
- F04B 1/2007 ... {Arrangements for pressing the cylinder barrel against the valve plate, e.g. by fluid pressure}
- F04B 1/2014 ... {Component parts}
- F04B 1/2021 {Particularities in the contacting area between cylinder barrel or valve plate}
- F04B 1/2028 {Bearing means}
- F04B 1/2035 {Cylinder barrel}
- F04B 1/2042 {Valve means}
- F04B 1/205 {Cylindrical valve means}
- F04B 1/2057 {Conical valve means}
- F04B 1/2064 {Pumphousing}
- F04B 1/2071 {Cylinder barrel bearing means}
- F04B 1/2078 {Swash plate}
- F04B 1/2085 {Swash plate bearing means or driving axis bearing means}
- F04B 1/2092 ... {Connection between rotating cylinder barrel and rotating inclined swash plate}
- F04B 1/22 ... having two or more sets of cylinders or pistons
- F04B 1/24 inclined to main shaft axis
- F04B 1/26 .. Control
- F04B 1/28 ... for machines or pumps with stationary cylinders
- F04B 1/29 by varying the relative positions of a swash plate and a cylinder block
- F04B 1/295 {by changing the inclination of the swash plate}
- F04B 1/30 ... for machines or pumps with rotary cylinder block
- F04B 1/303 {by turning the valve plate}

- F04B 1/306 {by turning the swash plate (with fixed inclination)}
- F04B 1/32 by varying the relative positions of a swash plate and a cylinder block
- F04B 1/322 {by moving the swash plate in a direction perpendicular to the axis of rotation of the cylinder barrel}
- F04B 1/324 {by changing the inclination of the swash plate}
- F04B 1/326 {using wedges}
- F04B 1/328 {by changing the inclination of the axis of the cylinder barrel relative to the swash plate (F04B 1/30 takes precedence)}

- F04B 1/34 Control not provided for in a single group of groups [F04B 1/02](#) to [F04B 1/32](#)

F04B 3/00 Machines or pumps with pistons coaxial within one cylinder e.g. multi-stage

- F04B 3/003 . . {with two or more pistons reciprocating one within another, e.g. one piston forming cylinder of the other}
- F04B 3/006 . . {with rotating cylinder block}

F04B 5/00 Machines or pumps with differential surface pistons

- F04B 5/02 . . with double-acting pistons

F04B 7/00 Piston machines or pumps characterised by having positively-driven valving (with cylinders in star- or fan-arrangement [F04B 1/04](#); with cylinder axes coaxial with, or parallel or inclined to, main shaft axis [F04B 1/12](#))

- F04B 7/0003 . . {the distribution member forming both the inlet and discharge distributor for one single pumping chamber ([F04B 7/0208](#) takes precedence)}
- F04B 7/0007 . . {and having a rotating movement}
- F04B 7/0011 . . {and having an oscillating movement}
- F04B 7/0015 . . {and having a slidable movement}
- F04B 7/0019 . . {a common distribution member forming a single discharge distributor for a plurality of pumping chambers ([F04B 7/0233](#) takes precedence)}
- F04B 7/0023 . . {and having a rotating movement}
- F04B 7/0026 . . {and having an oscillating movement}
- F04B 7/003 . . {and having a slidable movement}
- F04B 7/0034 . . {and having an orbital movement, e.g. elbow-pipe type members}
- F04B 7/0038 . . {the distribution member forming a single inlet for a plurality of pumping chambers or a multiple discharge for one single pumping chamber}
- F04B 7/0042 . . {with specific kinematics of the distribution member ([F04B 7/0003](#), [F04B 7/0019](#) take precedence)}
- F04B 7/0046 . . {for rotating distribution members}
- F04B 7/0049 . . {for oscillating distribution members}
- F04B 7/0053 . . {for reciprocating distribution members}

WARNING

Groups [F04B 7/0057](#) to [F04B 7/0069](#) are not used for classification. The documents are in the process of being reclassified to subclass [F01L](#)

- F04B 7/0057 . {Mechanical driving means therefor, e.g. cams}
- F04B 7/0061 .. {for a rotating member}
- F04B 7/0065 ... {being mounted on the main shaft}
- F04B 7/0069 .. {for a sliding member}

- F04B 7/0073 . {the member being of the lost-motion type, e.g. friction-actuated members, or having means for pushing it against or pulling it from its seat}

- F04B 7/0076 . {the members being actuated by electro-magnetic means}

- F04B 7/008 . {the distribution being realised by moving the cylinder itself, e.g. by sliding or swinging ([F04B 7/0291](#) takes precedence)}

- F04B 7/0084 . {Component parts or details specially adapted therefor}
- F04B 7/0088 .. {Sealing arrangements between the distribution members and the housing}
- F04B 7/0092 ... {for oscillating distribution members}
- F04B 7/0096 ... {for pipe-type distribution members}

- F04B 7/02 . the valving being fluid-actuated
- F04B 7/0208 .. {the distribution member forming both the inlet and discharge distributor for one single pumping chamber}
- F04B 7/0216 ... {and having an oscillating movement}
- F04B 7/0225 ... {and having a slidable movement}
- F04B 7/0233 .. {a common distribution member forming a single discharge distributor for a plurality of pumping chambers}
- F04B 7/0241 ... {and having an oscillating movement}
- F04B 7/025 ... {and having a slidable movement}
- F04B 7/0258 ... {and having an orbital movement, e.g. elbow-pipe type members}
- F04B 7/0266 .. {the inlet and discharge means being separate members}
- F04B 7/0275 ... {and being deformable, e.g. membranes}
- F04B 7/0283 ... {and having a rotating movement}
- F04B 7/0291 .. {the distribution being realised by moving the cylinder itself, e.g. by sliding or swinging}

- F04B 7/04 . in which the valving is performed by pistons and cylinders coacting to open and close intake or outlet ports
- F04B 7/045 .. {Two pistons coacting within one cylinder}
- F04B 7/06 .. the pistons and cylinders being relatively reciprocated and rotated

- F04B 9/00** **Piston machines or pumps characterised by the driving or driven means to or from their working members**

- F04B 9/02 . the means being mechanical
- F04B 9/025 .. {Driving of pistons coacting within one cylinder}
- F04B 9/04 .. the means being cams, eccentrics, or pin-and-slot mechanisms (with cylinder axes coaxial with, or parallel or inclined to, main shaft axis [F04B 1/12](#))
- F04B 9/042 ... {the means being cams}
- F04B 9/045 ... {the means being eccentrics}
- F04B 9/047 ... {the means being pin-and-slot mechanisms}
- F04B 9/06 .. the means including spring- or weight-loaded lost-motion devices

- F04B 9/08 . the means being fluid
- F04B 9/10 .. the fluid being liquid
- F04B 9/103 ... having only one pumping chamber
- F04B 9/1035 {the movement of the pump piston in the two directions being obtained by two single-acting liquid motors each acting in one direction}
- F04B 9/105 reciprocating movement of the pumping member being obtained by a double-acting liquid motor
- F04B 9/1053 {one side of the double-acting liquid motor being always under the influence of the liquid under pressure}
- F04B 9/1056 { with fluid-actuated inlet or outlet valve (mechanically controlled [F04B 7/00](#))}
- F04B 9/107 rectilinear movement of the pumping member in the working direction being obtained by a single-acting liquid motor, e.g. actuated in the other direction by gravity or a spring
- F04B 9/1073 {with actuation in the other direction by gravity}
- F04B 9/1076 {with fluid-actuated inlet or outlet valve (mechanically controlled [F04B 7/00](#))}
- F04B 9/109 ... having plural pumping chambers
- F04B 9/1095 {having two or more pumping chambers in series}
- F04B 9/111 with two mechanically connected pumping members
- F04B 9/1115 {the movement of the pumping pistons in only one direction being obtained by a single-acting piston liquid motor, e.g. actuation in the other direction by spring means}
- F04B 9/113 reciprocating movement of the pumping members being obtained by a double-acting liquid motor
- F04B 9/115 reciprocating movement of the pumping members being obtained by two single-acting liquid motors, each acting in one direction
- F04B 9/117 the pumping members not being mechanically connected to each other
- F04B 9/1172 {the movement of each pump piston in the two directions being obtained by a double-acting piston liquid motor}
- F04B 9/1174 {with fluid-actuated inlet or outlet valve (mechanically controlled [F04B 7/00](#))}
- F04B 9/1176 {the movement of each piston in one direction being obtained by a single-acting piston liquid motor}
- F04B 9/1178 {the movement in the other direction being obtained by a hydraulic connection between the liquid motor cylinders}
- F04B 9/12 .. the fluid being elastic, e.g. steam or air

- F04B 9/1207 . . . {using a source of partial vacuum or sub-atmospheric pressure}
- F04B 9/1215 {the return stroke being obtained by a spring}
- F04B 9/1222 {the return stroke being obtained by an elastic fluid under pressure}
- F04B 9/123 . . . having only one pumping chamber
- F04B 9/1235 {the movement of the pump piston in the two directions being obtained by two single-acting piston fluid motors, each acting in one direction}
- F04B 9/125 reciprocating movement of the pumping member being obtained by a double-acting elastic-fluid motor
- F04B 9/1253 {one side of the double-acting piston fluid motor being always under the influence of the fluid under pressure}
- F04B 9/1256 {with fluid-actuated inlet or outlet valve (mechanically controlled [F04B 7/00](#))}
- F04B 9/127 rectilinear movement of the pumping member in the working direction being obtained by a single-acting elastic-fluid motor, e.g. actuated in the other direction by gravity or a spring
- F04B 9/1273 {with actuation in the other direction by gravity}
- F04B 9/1276 {with fluid-actuated inlet or outlet valve (mechanically controlled [F04B 7/00](#))}
- F04B 9/129 . . . having plural pumping chambers
- F04B 9/1295 {having two or more pumping chambers in series}
- F04B 9/131 with two mechanically connected pumping members
- F04B 9/1315 {the movement of the pumping pistons in only one direction being obtained by a single-acting piston fluid motor, e.g. actuation in the other direction by spring means}
- F04B 9/133 reciprocating movement of the pumping members being obtained by a double-acting elastic-fluid motor
- F04B 9/135 reciprocating movement of the pumping members being obtained by two single-acting elastic-fluid motors, each acting in one direction
- F04B 9/137 the pumping members not being mechanically connected to each other
- F04B 9/1372 {the movement of each pump piston in the two directions is obtained by a double-acting piston fluid motor}
- F04B 9/1374 {with fluid-actuated inlet or outlet valve (mechanically controlled [F04B 7/00](#))}
- F04B 9/1376 {the movement of each piston in one direction being obtained by a single-acting piston fluid motor}
- F04B 9/1378 {the movement in the other direction being obtained by an hydraulic connection between the fluid motor cylinders}
- F04B 9/14 . . . Pumps characterised by muscle-power operation {hand-held spraying or dispensing apparatus using pumps or bulbs [B05B 11/00](#)}

F04B 11/00 Equalisation of pulses, e.g. by use of air vessels; Counteracting cavitation

- F04B 11/0008 . . {using accumulators}
- F04B 11/0016 . . . {with a fluid spring}
- F04B 11/0025 . . . {the spring fluid being in direct contact with the pumped fluid}
- F04B 11/0033 . . . {with a mechanical spring}

- F04B 11/0041 . {by piston speed control ([F04B 11/0058](#) takes precedence)}
- F04B 11/005 . {using two or more pumping pistons}
- F04B 11/0058 .. {with piston speed control}
- F04B 11/0066 ... {with special shape of the actuating element}
- F04B 11/0075 .. {connected in series}
- F04B 11/0083 ... {the pistons having different cross-sections}
- F04B 11/0091 . {using a special shape of fluid pass, e.g. throttles, ducts}

- F04B 13/00** **Pumps specially modified to deliver fixed or variable measured quantities (for transferring liquid from bulk storage containers or reservoirs into vehicles or into portable containers [B67D 5/40](#))**
- F04B 13/02 . of two or more fluids at the same time

- F04B 15/00** **Pumps adapted to handle specific fluids, e.g. by selection of specific materials for pumps or pump parts**
- F04B 15/02 . the fluids being viscous or non-homogeneous
- F04B 15/023 .. {supply of fluid to the pump by gravity through a hopper, e.g. without intake valve}
- F04B 15/04 . the fluids being hot or corrosive ([F04B 15/06](#) takes precedence)
- F04B 15/06 . for liquids near their boiling point, e.g. under subnormal pressure
- F04B 15/08 .. the liquids having low boiling points

- F04B 17/00** **Pumps characterised by combination with, or adaptation to, specific driving engines or motors**
- F04B 17/003 . {driven by piezo-electric means ([F04B 43/046](#) and [F04B 43/095](#) take precedence)}
- F04B 17/006 . {Solar operated}
- F04B 17/02 . driven by wind motors
- F04B 17/03 . driven by electric motors
- F04B 17/04 .. using solenoids
- F04B 17/042 ... {the solenoid motor being separated from the fluid flow}
- F04B 17/044 {using solenoids directly actuating the piston}
- F04B 17/046 ... {the fluid flowing through the moving part of the motor}
- F04B 17/048 ... {the fluid flowing around the moving part of the motor}
- F04B 17/05 . driven by internal-combustion engines
- F04B 17/06 . Mobile combinations

- F04B 19/00** **Machines or pumps having pertinent characteristics not provided for in, or of interest apart from, groups [F04B 1/00](#) to [F04B 17/00](#)**
- F04B 19/003 . {free-piston type pumps}
- F04B 19/006 . {Micro pumps ([F04B 43/043](#) and [F04B 43/095](#) take precedence)}
- F04B 19/02 . having movable cylinders
- F04B 19/022 .. {reciprocating cylinders}
- F04B 19/025 .. {cylinders rotating around their own axis}
- F04B 19/027 .. {cylinders oscillating around an axis perpendicular to their own axis}
- F04B 19/04 . Pumps for special use (for transferring liquids from bulk storage containers or reservoirs into vehicles or into portable containers **B67D 5/40**)
- F04B 19/06 .. Pumps for delivery of both liquid and elastic fluid at the same time ([wet gas pumps F04B 37/20](#))
- F04B 19/08 . Scoop devices
- F04B 19/10 .. of wheel type
- F04B 19/12 .. of helical or screw-type
- F04B 19/14 .. of endless-chain type, e.g. with the chains carrying pistons co-operating with open-ended cylinders
- F04B 19/16 . Adhesion-type liquid-lifting devices
- F04B 19/18 .. Adhesion members therefor
- F04B 19/20 . Other positive-displacement pumps
- F04B 19/22 .. of reciprocating-piston type
- F04B 19/24 .. Pumping by heat expansion of pumped fluid
- F04B 23/00** **Pumping installations or systems ([F04B 17/00](#) takes precedence)**
- F04B 23/02 . having reservoirs
- F04B 23/021 .. {the pump being immersed in the reservoir}
- F04B 23/023 ... {only the pump-part being immersed, the driving-part being outside the reservoir}
- F04B 23/025 .. {the pump being located directly adjacent the reservoir}
- F04B 23/026 ... {a pump-side forming a wall of the reservoir}
- F04B 23/028 ... {the pump being mounted on top of the reservoir}
- F04B 23/04 . Combinations of two or more pumps
- F04B 23/06 .. the pumps being all of reciprocating positive-displacement type
- F04B 23/08 .. the pumps being of different types
- F04B 23/10 ... at least one pump being of the reciprocating positive-displacement type
- F04B 23/103 {being a radial piston pump}

- F04B 23/106 {being an axial piston pump}
- F04B 23/12 . . . at least one pump being of the rotary-piston positive-displacement type
([F04B 23/10](#) takes precedence)
- F04B 23/14 . . . at least one pump being of the non-positive-displacement type ([F04B 23/10](#),
[F04B 23/12](#) take precedence)

Pumps specially adapted for elastic fluids (having a flexible working member
[F04B 45/00](#); for raising fluid from great depths [F04B 47/00](#))

F04B 25/00 **Multi-stage pumps**

- F04B 25/005 . {with two cylinders}
- F04B 25/02 . of stepped piston type
- F04B 25/04 . having cylinders coaxial with, or parallel or inclined to, main shaft axis

F04B 27/00 **Multi-cylinder pumps characterised by number or arrangement of cylinders** ([F04B 25/00](#) takes precedence; control of reciprocating machines or pumps in general [F04B 49/00](#))

- F04B 27/005 . {with two cylinders}
- F04B 27/02 . having cylinders arranged oppositely relative to main shaft
- F04B 27/04 . having cylinders in star- or fan-arrangement
- F04B 27/0404 . . {Details, component parts specially adapted for such pumps}
- F04B 27/0409 . . . {Pistons}
- F04B 27/0414 . . . {Cams}
- F04B 27/0418 {consisting of several cylindrical elements, e.g. rollers}
- F04B 27/0423 . . . {Cylinders}
- F04B 27/0428 . . . {Arrangements for pressing or connecting the pistons against the actuated cam}
- F04B 27/0432 {hydraulically}
- F04B 27/0437 . . . {Disconnecting the pistons from the actuated cam (in general [F01B 31/24](#))}
- F04B 27/0442 . . . {Supporting and guiding means for the pistons}
- F04B 27/0446 . . . {Draining of the engine housing; Arrangements dealing with leakage fluid}
- F04B 27/0451 . . . {Particularities relating to the distribution members ([F04B 27/0472](#),
[F04B 27/0531](#) and [F04B 27/0535](#) take precedence)}
- F04B 27/0456 {to cylindrical distribution members}
- F04B 27/046 {to conical distribution members}
- F04B 27/0465 {to plate like distribution members}
- F04B 27/047 . . with an actuating element at the outer ends of the cylinders
- F04B 27/0472 . . . {with cam-actuated distribution members}
- F04B 27/0474 . . . {with two or more series radial piston-cylinder units}
- F04B 27/0476 {directly located side-by-side}

- F04B 27/0478 {Coupling of several cylinder-barrels}
- F04B 27/053 .. with an actuating element at the inner ends of the cylinders
- F04B 27/0531 ... {with cam-actuated distribution members}
- F04B 27/0533 {each machine piston being provided with channels, which are coaxing with the cylinder and are used as a distribution member for another piston-cylinder unit}
- F04B 27/0535 ... {the piston-driving cam being provided with an inlet or an outlet}
- F04B 27/0536 ... {with two or more series radial piston-cylinder units}
- F04B 27/0538 {directly located side-by-side}
- F04B 27/06 .. the cylinders being movable, e.g. rotary {(F04B 27/08 takes precedence)}
- F04B 27/0606 ... {having cylinders in star- or fan-arrangement, the connection of the pistons with an actuating element being at the outer ends of the cylinders}
- F04B 27/0612 {rotary cylinder block}
- F04B 27/0619 {cylinder block and actuating cam rotating together (F04B 27/0631 and F04B 27/0644 take precedence)}
- F04B 27/0625 {with two or more series radial piston cylinder units}
- F04B 27/0631 {cylinder block and actuating cam both rotating (F04B 27/0644 takes precedence)}
- F04B 27/0638 {directly located side by side}
- F04B 27/0644 {cylinder block and actuating cam both rotating}
- F04B 27/065 ... {having cylinders in star- or fan-arrangement, the connection of the pistons with an actuating element being at the inner ends of the cylinders}
- F04B 27/0657 {rotary cylinder block}
- F04B 27/0663 {the rotary cylinder being provided with only one piston, reciprocating within this cylinder}
- F04B 27/067 .. Control
- F04B 27/0673 ... {by using a valve in a system with several pumping chambers, wherein the flow-path through the chambers can be changed, e.g. series-parallel}
- F04B 27/0676 ... {by changing the phase relationship between the actuating cam and the distribution means}
- F04B 27/073 ... by varying the relative eccentricity between two members, e.g. a cam and a drive shaft

- F04B 27/08 . having cylinders coaxial with, or parallel or inclined to, main shaft axis
- F04B 27/0804 .. {having rotary cylinder block (see F01B 3/0032, F03C 1/0636, F03C 1/20)}
- F04B 27/0808 ... {having two or more sets of cylinders or pistons}
- F04B 27/0813 {inclined to main shaft axis}
- F04B 27/0817 ... {arrangements for pressing the cylinder barrel against the valve plate e.g. by fluid pressure}
- F04B 27/0821 ... {component parts, details, e.g. valves, sealings, lubrication}
- F04B 27/0826 {particularities in the contacting area between cylinder barrel and valve plate}
- F04B 27/083 {bearing means}
- F04B 27/0834 {cylinder barrel}
- F04B 27/0839 {valve means, e.g. valve plate}
- F04B 27/0843 {cylindrical valve means}

F04B 27/0847	.....	{conical valve means}
F04B 27/0852	....	{machine housing}
F04B 27/0856	.....	{cylinder barrel bearing means}
F04B 27/086	....	{swash plate}
F04B 27/0865	.....	{swash plate bearing means or driving axis bearing means}
F04B 27/0869	...	{connection between rotating cylinder barrel and rotating inclined swash plate}
F04B 27/0873	..	{Component parts, e.g. sealings; Manufacturing or assembly thereof}
F04B 27/0878	...	{Pistons}
F04B 27/0882	....	{piston shoe retaining means}
F04B 27/0886	....	{Piston shoes}
F04B 27/0891	...	{casings, housings}
F04B 27/0895	...	{driving means}
F04B 27/10	..	having stationary cylinders
F04B 27/1009	...	{Distribution members}
F04B 27/1018	....	{Cylindrical distribution members}
F04B 27/1027	....	{Conical distribution members}
F04B 27/1036	...	{Component parts, details, e.g. sealings, lubrication}
F04B 27/1045	....	{Cylinders}
F04B 27/1054	....	{Actuating elements}
F04B 27/1063	.....	{Actuating-element bearing means or driving-axis bearing means}
F04B 27/1072	.....	{Pivot mechanisms}
F04B 27/1081	....	{Casings, housings}
F04B 27/109	....	{Lubrication}
F04B 27/12	...	having plural sets of cylinders or pistons
F04B 27/14	..	Control
F04B 27/16	...	of pumps with stationary cylinders
F04B 27/18	....	by varying the relative positions of a swash plate and a cylinder block
F04B 27/1804	.....	{Controlled by crankcase pressure}
F04B 27/20	...	of pumps with rotary cylinder block
F04B 27/22	....	by varying the relative positions of a swash plate and a cylinder block
F04B 27/24	.	Control not provided for in a single group of groups F04B 27/02 to F04B 27/22

F04B 29/00 Other pumps with movable, e.g. rotatable cylinders

F04B 31/00 **Free-piston pumps; Systems incorporating such pumps** (muscle-driven pumps in which the stroke is not defined by gearing [F04B 33/00](#); free-piston combustion engines, free-piston gas generators [F02B 71/00](#); systems predominated by prime mover aspects, see the relevant classes for the prime mover)

F04B 33/00 Pumps actuated by muscle power, e.g. for inflating

F04B 33/005 . {specially adapted for inflating tyres of non-motorised vehicles, e.g. cycles, tricycles}

- F04B 33/02 . with intermediate gearing

- F04B 35/00** **Piston pumps characterised by the driving means to their working members, or by combination with, or adaptation to, specific driving engines or motors, not otherwise provided for (predominant aspects of the engines or motors, see the relevant classes)**

- F04B 35/002 . {driven by internal combustion engines}
- F04B 35/004 . {driven by floating elements}
- F04B 35/006 . {driven by steam engines}
- F04B 35/008 . {the means being a fluid transmission link}
- F04B 35/01 . the means being mechanical
- F04B 35/04 . the means being electric
- F04B 35/045 .. {using solenoids}
- F04B 35/06 . Mobile combinations

- F04B 37/00** **Pumps having pertinent characteristics not provided for in, or of interest apart from, groups [F04B 25/00](#) to [F04B 35/00](#)**

- F04B 37/02 . for evacuating by absorption or adsorption (absorption or adsorption in general [B01J](#); {for gas-filled discharge tubes see [H01J 17/24](#)})
- F04B 37/04 .. Selection of specific absorption or adsorption materials

- F04B 37/06 . for evacuating by thermal means
- F04B 37/08 .. by condensing or freezing, e.g. cryogenic pumps (cold traps [B01D 8/00](#))
- F04B 37/085 ... {Regeneration of cyro-pumps}

- F04B 37/10 . for special use ([F04B 37/02](#), [F04B 37/06](#) take precedence)
- F04B 37/12 .. to obtain high pressure
- F04B 37/14 .. to obtain high vacuum
- F04B 37/16 ... Means for nullifying unswept space
- F04B 37/18 .. for specific elastic fluid
- F04B 37/20 ... for wet gases, e.g. wet air

- F04B 39/00** **Component parts, details, or accessories, of pumps or pumping systems, not otherwise provided for in, or of interest apart from, groups [F04B 25/00](#) to [F04B 37/00](#)(for controlling [F04B 49/00](#))**

- F04B 39/0005 . {adaptations of pistons}
- F04B 39/0011 .. {liquid pistons}
- F04B 39/0016 .. {with valve arranged in the piston}

- F04B 39/0022 .. {piston rods}
- F04B 39/0027 . {Pulsation and noise damping means}
- F04B 39/0033 .. {with encapsulations}
- F04B 39/0038 ... {of inlet or outlet channels}
- F04B 39/0044 .. {with vibration damping supports}
- F04B 39/005 .. {with direct action on the fluid flow using absorptive materials}
- F04B 39/0055 .. {with a special shape of fluid passage, e.g. bends, throttles, diameter changes, pipes}
- F04B 39/0061 ... {using muffler volumes}
- F04B 39/0066 ... {using sidebranch resonators, e.g. Helmholtz resonators}
- F04B 39/0072 ... {characterised by assembly or mounting}
- F04B 39/0077 .. {by generating oil foam}
- F04B 39/0083 .. {using blow off silencers}
- F04B 39/0088 .. {using mechanical tuned resonators}
- F04B 39/0094 . {crankshaft}
- F04B 39/02 . Lubrication (of machines or engines in general [F01M](#))
- F04B 39/0207 .. {with lubrication control systems}
- F04B 39/0215 .. {characterised by the use of a special lubricant}
- F04B 39/0223 .. {characterised by the compressor type (swash-plate compressors [F04B 27/109](#))}
- F04B 39/023 ... {Hermetic compressors}
- F04B 39/0238 {with oil distribution channels}
- F04B 39/0246 {in the rotating shaft}
- F04B 39/0253 {using centrifugal force for transporting the oil}
- F04B 39/0261 {with an auxiliary oil pump}
- F04B 39/0269 {with device for spraying lubricant or with mist lubrication}
- F04B 39/0276 ... {the pump being of the reciprocating piston type, e.g. oscillating, free-piston compressors}
- F04B 39/0284 .. { Constructional details, e.g. reservoirs in the casing (swash-plate compressors [F04B 27/0878](#), [F04B 27/109](#))}
- F04B 39/0292 ... {Lubrication of pistons or cylinders}
- F04B 39/04 . Measures to avoid lubricant contaminating the pumped fluid
- F04B 39/041 .. {sealing for a reciprocating rod (sealing in general [F16J](#))}
- F04B 39/042 ... {sealing being provided on the piston}
- F04B 39/044 ... {sealing with a rolling diaphragm between piston and cylinder}
- F04B 39/045 ... {Labyrinth-sealing between piston and cylinder}
- F04B 39/047 ... {Sealing between piston and carter being provided by a bellow}
- F04B 39/048 ... {Sealing between piston and carter being provided by a diaphragm}
- F04B 39/06 . Cooling (of machines or engines in general [F01P](#)); Heating; Prevention of freezing
- F04B 39/062 .. {Cooling by injecting a liquid in the gas to be compressed}
- F04B 39/064 .. {Cooling by a cooling jacket in the pump casing}

- F04B 39/066 .. {Cooling by ventilation}
- F04B 39/068 .. {prevention of freezing}

- F04B 39/08 . Actuation of distribution members

- F04B 39/10 . Adaptations or arrangements of distribution members
- F04B 39/1006 .. {the members being ball valves}
- F04B 39/1013 .. {the members being of the poppet valve type}
- F04B 39/102 .. {the members being disc valves}
- F04B 39/1026 ... {without spring ([F04B 39/1033](#) takes precedence)}
- F04B 39/1033 ... {annular disc valves}
- F04B 39/104 .. {the members being parallel flexible strips}
- F04B 39/1046 .. {Combination of in- and outlet valve}
- F04B 39/1053 .. {the members being Hoerbigen valves}
- F04B 39/106 .. {the members being parallel non-flexible strips}
- F04B 39/1066 .. {Valve plates}
- F04B 39/1073 .. {the members being reed valves}
- F04B 39/108 ... {circular reed valves}
- F04B 39/1086 ... {flat annular reed valves}
- F04B 39/1093 .. {the members being low-resistance valves allowing free streaming}

- F04B 39/12 . Casings ([casings for machines or engines in general F16M](#)); Cylinders; Cylinders heads; Fluid connections
- F04B 39/121 .. {Casings}
- F04B 39/122 .. {Cylinder block}
- F04B 39/123 .. {Fluid connections}
- F04B 39/125 .. {Cylinder heads}
- F04B 39/126 .. {Cylinder liners}
- F04B 39/127 .. {Mounting of a cylinder block in a casing}
- F04B 39/128 .. {Crankcases}

- F04B 39/14 . Provisions for readily assembling or disassembling

- F04B 39/16 . Filtration; Moisture separation

- F04B 41/00** **Pumping installations or systems** ([F04B 31/00](#), [F04B 35/00](#) take precedence)

- F04B 41/02 . having reservoirs

- F04B 41/04 . Conversion of internal-combustion engine cylinder units to pumps

- F04B 41/06 . Combinations of two or more pumps

Machines or pumps having flexible working members

- F04B 43/00** **Machines, pumps, or pumping installations having flexible working members**
(pumps or pumping installations specially adapted for elastic fluids [F04B 45/00](#))
- F04B 43/0009 . {Special features}
 - F04B 43/0018 .. {the periphery of the flexible member being not fixed to the pump-casing, but acting as a valve}
 - F04B 43/0027 .. {without valves}
 - F04B 43/0036 .. {the flexible member being formed as an O-ring}
 - F04B 43/0045 .. {with a number of independent working chambers which are actuated successively by one mechanism}
 - F04B 43/0054 .. {particularities of the flexible members}
 - F04B 43/0063 ... {bell-shaped flexible members}
 - F04B 43/0072 ... {of tubular flexible members}
 - F04B 43/0081 .. {systems, control, safety measures}
 - F04B 43/009 ... {leakage control; pump systems with two flexible members; between the actuating element and the pumped fluid}

 - F04B 43/02 . having plate-like flexible members, e.g. diaphragms
 - F04B 43/021 .. {the plate-like flexible member is pressed against a wall by a number of elements, each having an alternating movement in a direction perpendicular to the plane of the plate-like flexible member and each having its own driving mechanism}
 - F04B 43/023 .. {double acting plate-like flexible member}
 - F04B 43/025 .. {two or more plate-like pumping members in parallel}
 - F04B 43/026 ... {each plate-like pumping flexible member working in its own pumping chamber}
 - F04B 43/028 .. {with in- or outlet valve arranged in the plate-like flexible member (valve arranged in the piston [F04B 53/12](#))}
 - F04B 43/04 .. Pumps having electric drive
 - F04B 43/043 ... {Micro pumps}
 - F04B 43/046 {with piezo-electric drive}
 - F04B 43/06 .. Pumps having fluid drive
 - F04B 43/067 ... the fluid being actuated directly by a piston
 - F04B 43/073 ... the actuating fluid being controlled by at least one valve
 - F04B 43/0733 {with fluid-actuated pump inlet or outlet valves; with two or more pumping chambers in series}
 - F04B 43/0736 {with two or more pumping chambers in parallel}

 - F04B 43/08 . having tubular flexible members ([F04B 43/12](#) takes precedence)
 - F04B 43/082 .. {the tubular flexible member being pressed against a wall by a number of elements, each having an alternating movement in a direction perpendicular to the axes of the tubular member and each having its own driving mechanism}
 - F04B 43/084 .. {the tubular member being deformed by stretching ou distersion}
 - F04B 43/086 .. {with two or more tubular flexible members in parallel ([F04B 43/1136](#) takes precedence)}
 - F04B 43/088 .. {with two or more tubular flexible members in series ([F04B 43/1133](#) takes precedence)}

- F04B 43/09 .. Pumps having electric drive
- F04B 43/095 ... {Piezo-electric drive}
- F04B 43/10 .. Pumps having fluid drive
- F04B 43/107 ... the fluid being actuated directly by a piston
- F04B 43/113 ... the actuating fluid being controlled by at least one valve
- F04B 43/1133 {with fluid-actuated pump inlet or outlet valves; with two or more pumping chambers in series}
- F04B 43/1136 {with two or more pumping chambers in parallel}

- F04B 43/12 . having peristaltic action
- F04B 43/1207 .. {the actuating element being a swash plate}
- F04B 43/1215 .. {having no backing plate (deforming of the tube only by rollers)}
- F04B 43/1223 .. {the actuating elements, e.g. rollers, moving in a straight line during squeezing}
- F04B 43/123 .. {using an excenter as the squeezing element}
- F04B 43/1238 .. {using only one roller as the squeezing element, the roller moving on an arc of a circle during squeezing}
- F04B 43/1246 ... {the roller being placed at the outside of the tubular flexible member}
- F04B 43/1253 .. {by using two or more rollers as squeezing elements, the rollers moving on an arc of a circle during squeezing}
- F04B 43/1261 ... {the rollers being placed at the outside of the tubular flexible member}
- F04B 43/1269 ... {the rotary axes of the rollers lying in a plane perpendicular to the rotary axis of the driving motor}
- F04B 43/1276 ... {Means for pushing the rollers against the tubular flexible member}
- F04B 43/1284 ... {Means for pushing the backing-plate against the tubular flexible member}
- F04B 43/1292 ... {Pumps specially adapted for several tubular flexible members}
- F04B 43/14 .. having plate-like flexible members

F04B 45/00 Pumps or pumping installations having flexible working members and specially adapted for elastic fluids

- F04B 45/02 . having bellows
- F04B 45/022 .. {with two or more bellows in parallel}
- F04B 45/024 .. {with two or more bellows in series}
- F04B 45/027 .. having electric drive
- F04B 45/033 .. having fluid drive
- F04B 45/0333 ... {the fluid being actuated directly by a piston}
- F04B 45/0336 ... {the actuating fluid being controlled by one or more valves}

- F04B 45/04 . having plate-like flexible members, e.g. diaphragms
- F04B 45/041 .. {double acting plate-like flexible pumping member}
- F04B 45/043 .. {two or more plate-like pumping flexible members in parallel}
- F04B 45/045 .. {with in- or outlet valve arranged in the plate-like pumping flexible members}
- F04B 45/047 .. Pumps having electric drive
- F04B 45/053 .. Pumps having fluid drive

- F04B 45/0533 . . . {the fluid being actuated directly by a piston}
- F04B 45/0536 . . . {the actuating fluid being controlled by one or more valves}

- F04B 45/06 . . . having tubular flexible members ([F04B 45/02](#) takes precedence)
- F04B 45/061 . . . {with fluid drive}
- F04B 45/062 . . . {the fluid being actuated directly by a piston}
- F04B 45/064 . . . {the actuating fluid being controlled by one or more valves}
- F04B 45/065 . . . {with electric drive}
- F04B 45/067 . . . Pumps having electric drive
- F04B 45/073 . . . Pumps having fluid drive
- F04B 45/0733 . . . {the fluid being actuated directly by a piston}
- F04B 45/0736 . . . {the actuating fluid being controlled by one or more valves}
- F04B 45/08 . . . having peristaltic action
- F04B 45/085 . . . {the actuating element being a swash plate}
- F04B 45/10 . . . having plate-like flexible members

- F04B 47/00** **Pumps or pumping installation specially adapted for raising fluids from great depths, e.g. well pumps** (by using positive or negative pressurised fluid medium acting directly on the liquid to be pumped [F04F 1/00](#))

- F04B 47/005 . . . {Sand trap arrangements}

- F04B 47/02 . . . the driving mechanisms being situated at ground level ([F04B 47/12](#) takes precedence)
- F04B 47/022 . . . {driving of the walking beam}
- F04B 47/024 . . . {actuated by muscle power}
- F04B 47/026 . . . {Pull rods, full rod component parts}
- F04B 47/028 . . . {details of the walking beam}
- F04B 47/04 . . . the driving means incorporating fluid means

- F04B 47/06 . . . having motor-pump units situated at great depth
- F04B 47/08 . . . the motor being actuated by fluid
- F04B 47/10 . . . the units or parts thereof being liftable to ground level by fluid pressure

- F04B 47/12 . . . having free plunger lifting the fluid to the surface

- F04B 47/14 . . . Counterbalancing
- F04B 47/145 . . . with fluid means

- F04B 49/00** **Control {e.g. of pump delivery, or pump pressure} of, or safety measures for, machines, pumps, or pumping installations, not otherwise provided for, or of interest apart from, groups [F04B 1/00](#) to [F04B 47/00](#)**

NOTE

The classification symbols in group [F04B 49/00](#) and subgroups can be followed by additional symbols preceded by the sign "+". The symbols are applied in subgroups

[F04B 49/06](#), [F04B 49/08](#), [F04B 49/16](#) and [F04B 49/225](#). The symbols have the meanings as listed below:

+C specially adapted for pumps for elastic fluids,
e.g. compressors
+P specially adapted for pumps for liquids

- [F04B 49/002](#) . {Hydraulic systems to change the pump delivery}
- [F04B 49/005](#) . {changing the phase relationship of two working pistons in one working chamber or the phase-relationship of a piston and a driven distribution member}
- [F04B 49/007](#) . {Installations or systems with two or more pumps or pump cylinders, wherein the flow-path through the stages can be changed, e.g. from series to parallel (**centrifugal pumps [F04D 15/0072](#)**)}
- [F04B 49/02](#) . Stopping, starting, unloading or idling control (**controlled electrically [F04B 49/06](#)**)
- [F04B 49/022](#) .. {by means of pressure}
- [F04B 49/025](#) .. by means of floats
- [F04B 49/03](#) .. by means of valves
- [F04B 49/035](#) ... Bypassing
- [F04B 49/04](#) . Regulating by means of floats (**[F04B 49/025](#) takes precedence**)
- [F04B 49/06](#) . Control using electricity (**regulating by means of floats actuating electric switches [F04B 49/04](#)**)
- [F04B 49/065](#) .. {and making use of computers}
- [F04B 49/08](#) . Regulating by delivery pressure
- [F04B 49/10](#) . Other safety measures
- [F04B 49/103](#) .. {Responsive to speed}
- [F04B 49/106](#) .. {Responsive to pumped volume}
- [F04B 49/12](#) . by varying the length of stroke of the working members
- [F04B 49/121](#) .. {Lost-motion device in the driving mechanism}
- [F04B 49/123](#) .. {by changing the eccentricity of one element relative to another element}
- [F04B 49/125](#) ... {by changing the eccentricity of the actuation means, e.g. cams or cranks, relative to the driving means, e.g. driving shafts (**[F04B 49/128](#) takes precedence**)}
- [F04B 49/126](#) {with a double eccentric mechanism}
- [F04B 49/128](#) ... {by changing the eccentricity of the cylinders, e.g. by moving a cylinder block}
- [F04B 49/14](#) .. Adjusting abutments located in the path of reciprocation
- [F04B 49/16](#) . by adjusting the capacity of dead spaces of working chambers
- [F04B 49/18](#) . by changing the effective cross-section of the working surface of the piston

- F04B 49/20 . by changing the driving speed ([controlled electrically F04B 49/06](#))
- F04B 49/22 . by means of valves ([F04B 49/03 takes precedence](#))
- F04B 49/225 .. {with throttling valves or valves varying the pump inlet opening or the outlet opening}
- F04B 49/24 .. Bypassing
- F04B 49/243 ... {by keeping open the inlet valve}
- F04B 49/246 ... {by keeping open the outlet valve}

- F04B 51/00** **Testing machines, pumps, or pumping installations**

- F04B 53/00** **Component parts, details or accessories not provided for in, or of interest apart from, groups [F04B 1/00](#) to [F04B 23/00](#) or [F04B 39/00](#) to [F04B 47/00](#)**

- F04B 53/001 . {Noise damping}

- WARNING**
- Group [F04B 53/001](#) and subgroups are not complete, see [F04B 11/00](#), [F04B 53/16](#)

- F04B 53/002 .. {by encapsulation}
- F04B 53/003 .. {by damping supports}
- F04B 53/004 .. {by mechanical resonators}

- F04B 53/005 . {Adaptations or arrangements of valves used as foot valves, of suction strainers, or of mud-boxes}

- F04B 53/006 . {Crankshafts}

- F04B 53/007 . {Cylinder heads}

- F04B 53/008 . {Spacing or clearance between cylinder and piston}

- F04B 53/02 . Packing the free space between cylinders and pistons

- F04B 53/04 . Draining

- F04B 53/06 . Venting

- F04B 53/08 . Cooling ([of machines or engines in general F01P](#)); Heating; Preventing freezing

- F04B 53/10 . Valves; Arrangement of valves
- F04B 53/1002 .. {Ball valves}
- F04B 53/1005 ... {being formed by two closure members working in series}
- F04B 53/1007 ... {having means for guiding the closure member}
- F04B 53/101 ... {having means for limiting the opening height}
- F04B 53/1012 {and means for controlling the opening height}

F04B 53/1015	...	{Combinations of ball valves working in parallel}
F04B 53/1017	...	{Semi-spherical ball valves}
F04B 53/102	..	{Disc valves}
F04B 53/1022	...	{having means for guiding the closure member axially}
F04B 53/1025	....	{the guiding means being provided within the valve opening}
F04B 53/1027	....	{the guiding means being provided at both sides of the disc}
F04B 53/103	...	{Flat-annular type disc valves}
F04B 53/1032	...	{Spring-actuated disc valves (F04B 53/1022 , F04B 53/103 take precedence)}
F04B 53/1035	...	{with means for limiting the opening height}
F04B 53/1037	..	{Flap valves}
F04B 53/104	...	{the closure member being a rigid element oscillating around a fixed point}
F04B 53/1042	....	{by means of a flexible connection}
F04B 53/1045	....	{the valve being formed by two elements}
F04B 53/1047	...	{the valve being formed by one or more flexible elements}
F04B 53/105	....	{one flexible element oscillating around a fixed point}
F04B 53/1052	....	{two flexible elements oscillating around a fixed point}
F04B 53/1055	....	{more than two flexible elements oscillating around a fixed point}
F04B 53/1057	....	{the valve being a tube, e.g. normally closed at one end}
F04B 53/106	....	{the valve being a membrane}
F04B 53/1062	.....	{fixed at two or more points at its periphery}
F04B 53/1065	.....	{fixed at its centre}
F04B 53/1067	.....	{fixed at its whole periphery and with an opening at its centre}
F04B 53/107	.....	{the opening normally being closed by a fixed element}
F04B 53/1072	..	{the valve being an elastic body, the length thereof changing in the opening direction}
F04B 53/1075	..	{the valve being a flexible annular ring}
F04B 53/1077	..	{Flow resistance valves, e.g. without moving parts}
F04B 53/108	..	{Valves characterised by the material}
F04B 53/1082	...	{magnetic}
F04B 53/1085	..	{having means for limiting the opening height (F04B 53/101 and F04B 53/1035 take precedence)}
F04B 53/1087	..	{Valve seats}
F04B 53/109	..	{inlet and outlet valve forming one unit}
F04B 53/1092	...	{and one single element forming both the inlet and outlet closure member}
F04B 53/1095	..	{Valves linked to another valve of another pumping chamber}
F04B 53/1097	..	{with means for lifting the closure member for pump cleaning purposes}
F04B 53/12	..	arranged in or on pistons
F04B 53/121	...	{the valve being an annular ring surrounding the piston, e.g. an O-ring}
F04B 53/122	...	{the piston being free-floating, e.g. the valve being formed between the actuating rod and the piston}
F04B 53/123	...	{Flexible valves}
F04B 53/124	...	{Oscillating valves}
F04B 53/125	...	{Reciprocating valves}

- F04B 53/126 {Ball valves}
- F04B 53/127 {Disc valves}
- F04B 53/128 {Annular disc valves}
- F04B 53/129 {Poppet valves}

- F04B 53/14 . Pistons, piston-rods or piston-rod connections
- F04B 53/141 .. {Intermediate liquid piston between the driving piston and the pumped liquid
([F04B 43/06](#) and [F04B 43/10](#) take precedence)}
- F04B 53/142 .. {Intermediate liquid-piston between a driving piston and a driven piston ([F04B 9/10](#),
[F04B 43/06](#), [F04B 43/10](#) and [F04B 53/141](#) take precedence)}
- F04B 53/143 .. {Sealing provided on the piston}
- F04B 53/144 .. {Adaptation of piston-rods}
- F04B 53/145 ... {Rod shock absorber}
- F04B 53/146 ... {Piston-rod guiding arrangements}
- F04B 53/147 ... {Mounting or detaching of piston rod}
- F04B 53/148 .. {the piston being provided with channels which are coacting with the cylinder and
are used as a distribution member for another piston-cylinder unit}

- F04B 53/16 . Casings; Cylinders; Cylinder liners or heads; Fluid connections
- F04B 53/162 .. {Adaptations of cylinders}
- F04B 53/164 ... {Stuffing boxes}
- F04B 53/166 ... {Cylinder liners}
- F04B 53/168 {Mounting of cylinder liners in cylinders}

- F04B 53/18 . Lubricating (of machines or engines in general [F01M](#))

- F04B 53/20 . Filtering

- F04B 53/22 . Arrangements for enabling ready assembly or disassembly

- F04B 2015/00 Pumps adapted to handle specific fluids, e.g. by selection of specific materials for
pumps or pump parts**

- F04B 2015/02 . the fluids being viscous or non-homogeneous
- F04B 2015/026 .. with a priming plunger or piston ahead of the pumping piston and connected on the
same piston rod

- F04B 2015/06 . for liquids near their boiling point, e.g. under subnormal pressure
- F04B 2015/08 .. the liquids having low boiling points
- F04B 2015/081 ... Liquified gases
- F04B 2015/0812 Air
- F04B 2015/0814 Argon
- F04B 2015/0816 Carbon monoxide
- F04B 2015/0818 Carbon dioxide

F04B 2015/082	....	Helium
F04B 2015/0822	....	Hydrogen
F04B 2015/0824	....	Nitrogen
F04B 2015/0826	....	Oxygen

F04B 2027/00 **Multi-cylinder pumps characterised by number or arrangement of cylinders**
 ([F04B 25/00](#) takes precedence; control of reciprocating machines or pumps in general
[F04B 49/00](#))

F04B 2027/08	.	having cylinders coaxial with, or parallel or inclined to, main shaft axis
F04B 2027/14	..	Control
F04B 2027/16	...	of pumps with stationary cylinders
F04B 2027/18	....	by varying the relative positions of a swash plate and a cylinder block
F04B 2027/1804	.....	{Controlled by crankcase pressure}
F04B 2027/1809	.....	Controlled pressure
F04B 2027/1813	.....	Crankcase pressure
F04B 2027/1818	.....	Suction pressure
F04B 2027/1822	.....	Valve-controlled fluid connection
F04B 2027/1827	.....	between crankcase and discharge chamber
F04B 2027/1831	.....	between crankcase and suction chamber
F04B 2027/1836	.....	between crankcase and working chamber
F04B 2027/184	.....	Valve controlling parameter
F04B 2027/1845	.....	Crankcase pressure
F04B 2027/185	.....	Discharge pressure
F04B 2027/1854	.....	External parameters
F04B 2027/1859	.....	Suction pressure
F04B 2027/1863	.....	with an auxiliary valve, controlled by
F04B 2027/1868	.....	Crankcase pressure
F04B 2027/1872	.....	Discharge pressure
F04B 2027/1877	.....	External parameters
F04B 2027/1881	.....	Suction pressure
F04B 2027/1886	.....	Open (not controlling) fluid passage
F04B 2027/189	.....	between crankcase and discharge chamber
F04B 2027/1895	.....	between crankcase and suction chamber

F04B 2201/00 **Pump parameters**

F04B 2201/02	.	Piston parameters
F04B 2201/0201	..	Position of the piston
F04B 2201/02011	...	Angular position of a piston rotating around its own axis
F04B 2201/0202	..	Linear speed of the piston

F04B 2201/0203	..	Acceleration of the piston
F04B 2201/0204	..	Power on the piston
F04B 2201/0205	..	Piston ring wear
F04B 2201/0206	..	Length of piston stroke
F04B 2201/0207	..	Number of pumping strokes in unit time
F04B 2201/02071	...	Total number of pumping strokes
F04B 2201/0208	..	Leakage across the piston
F04B 2201/0209	..	Duration of piston stroke
F04B 2201/021	..	Rotational speed of a piston rotating around its own axis (F04B 7/06)
F04B 2201/04	.	Carter parameters
F04B 2201/0401	..	Carter pressure
F04B 2201/0402	..	Lubricating oil temperature
F04B 2201/0403	..	Carter housing temperature
F04B 2201/0404	..	Lubricating oil condition
F04B 2201/0405	..	Leakage
F04B 2201/0406	..	Pressure change across an oil filter
F04B 2201/06	.	Valve parameters
F04B 2201/0601	..	Opening times
F04B 2201/06011	...	of the inlet valve only
F04B 2201/06012	...	of the outlet valve only
F04B 2201/0602	..	Valve acceleration
F04B 2201/0603	..	Valve wear
F04B 2201/0604	..	Valve noise
F04B 2201/0605	..	Leakage over a valve
F04B 2201/0606	..	Opening width or height
F04B 2201/06061	...	of the inlet valve
F04B 2201/06062	...	of the outlet valve
F04B 2201/08	.	Cylinder or housing parameters
F04B 2201/0801	..	Temperature
F04B 2201/0802	..	Vibration
F04B 2201/0803	..	Leakage
F04B 2201/0804	..	Noise
F04B 2201/0805	..	Rotational speed of a rotating cylinder block
F04B 2201/0806	..	Resonant frequency
F04B 2201/0807	..	Number of working cylinders
F04B 2201/0808	..	Size of the dead volume
F04B 2201/12	.	Parameters of driving or driven means
F04B 2201/1201	..	Rotational speed of the axis
F04B 2201/1202	..	Torque on the axis

F04B 2201/1203	..	Power on the axis
F04B 2201/1204	..	Position of a rotating inclined plate
F04B 2201/12041	...	Angular position
F04B 2201/1205	..	Position of a non-rotating inclined plate
F04B 2201/12051	...	Angular position
F04B 2201/1206	..	Rotational speed of a rotating inclined plate
F04B 2201/1207	..	Wear of the bearings
F04B 2201/1208	..	Angular position of the shaft
F04B 2201/1209	..	Radial force on the bearings
F04B 2201/121	..	Load on the sucker rod
F04B 2201/1211	..	Position of the walking beam
F04B 2201/1212	..	Oil pressure in the bearings
F04B 2201/1213	..	Eccentricity of an outer annular cam
F04B 2201/124	..	Coupling parameters
F04B 2201/1241	...	Engagement
F04B 2201/127	..	Braking parameters

F04B 2203/00 **Motor parameters**

F04B 2203/02	.	of rotating electric motors
F04B 2203/0201	..	Current
F04B 2203/0202	..	Voltage
F04B 2203/0203	..	Magnetic flux
F04B 2203/0204	..	Frequency of the electric current
F04B 2203/0205	..	Temperature
F04B 2203/0206	..	Vibration
F04B 2203/0207	..	Torque
F04B 2203/0208	..	Power
F04B 2203/0209	..	Rotational speed
F04B 2203/021	..	Lubricating-oil temperature
F04B 2203/0211	..	Noise
F04B 2203/0212	..	Amplitude of the electric current
F04B 2203/0213	..	Pulses per unit of time (pulse motor)
F04B 2203/0214	..	Number of working motor-pump units
F04B 2203/04	.	of linear electric motors
F04B 2203/0401	..	Current
F04B 2203/0402	..	Voltage
F04B 2203/0403	..	Magnetic flux
F04B 2203/0404	..	Frequency of the electric current
F04B 2203/0405	..	Temperature

F04B 2203/0406	..	Vibration
F04B 2203/0407	..	Force
F04B 2203/0408	..	Power
F04B 2203/0409	..	Linear speed
F04B 2203/041	..	Lubricating-oil temperature
F04B 2203/0411	..	Noise
F04B 2203/06	.	of internal combustion engines
F04B 2203/0601	..	Temperature
F04B 2203/0602	..	Vibration
F04B 2203/0603	..	Torque
F04B 2203/0604	..	Power
F04B 2203/0605	..	Rotational speed
F04B 2203/0606	..	Lubricating-oil temperature
F04B 2203/0607	..	Fuel consumption
F04B 2203/06071	...	position of the carburettor valve
F04B 2203/09	.	of linear hydraulic motors
F04B 2203/0901	..	Opening time of the valves
F04B 2203/0902	..	Liquid pressure in a working chamber
F04B 2203/0903	..	Position of the driving piston
F04B 2203/091	...	Opening time of the valves
F04B 2203/10	.	of linear elastic fluid motors
F04B 2203/1001	..	Opening time of the valves
F04B 2203/11	.	of a gas turbine
F04B 2203/1101	..	Rotational speed of the turbine
F04B 2203/1102	..	Flow rate of the driving fluid
F04B 2203/1103	..	Rotation sense of the turbine
F04B 2203/12	.	of rotating hydraulic motors
F04B 2203/1201	..	Rotational speed
F04B 2203/1202	..	Pressure at the motor inlet
F04B 2205/00		Fluid parameters
F04B 2205/01	.	Pressure before the pump inlet
F04B 2205/02	.	Pressure in the inlet chamber
F04B 2205/03	.	Pressure in the compression chamber
F04B 2205/04	.	Pressure in the outlet chamber

- F04B 2205/05 . Pressure after the pump outlet
- F04B 2205/06 . Pressure in a (hydraulic) circuit
- F04B 2205/061 .. after a throttle
- F04B 2205/062 .. before a throttle
- F04B 2205/063 .. in a reservoir linked to the pump outlet
- F04B 2205/064 .. in a reservoir linked to the pump inlet
- F04B 2205/065 .. between two stages in a multi-stage pump
- F04B 2205/07 . Pressure difference over the pump
- F04B 2205/08 . Pressure difference over a throttle
- F04B 2205/0801 .. the throttle being a filter
- F04B 2205/09 . Flow through the pump
- F04B 2205/10 . Inlet temperature
- F04B 2205/11 . Outlet temperature
- F04B 2205/111 .. after a throttle
- F04B 2205/112 .. between two stages in a multi-stage pump
- F04B 2205/12 . Pressure pulsations before the pump
- F04B 2205/13 . Pressure pulsations after the pump
- F04B 2205/14 . Viscosity
- F04B 2205/15 . By-passing over the pump
- F04B 2205/151 .. Opening width of a bypass valve
- F04B 2205/16 . Opening or closing of a valve in a circuit
- F04B 2205/17 . Opening width of a throttling device
- F04B 2205/171 .. before the pump inlet
- F04B 2205/172 .. after the pump outlet
- F04B 2205/173 .. in a circuit
- F04B 2205/18 . Pressure in a control cylinder/piston unit
- F04B 2205/50 . Presence of foreign matter in the fluid
- F04B 2205/501 .. of solid particles
- F04B 2205/503 .. of gas in a liquid flow, e.g. gas bubbles
- F04B 2207/00 External parameters**
- F04B 2207/01 . Load in general

- F04B 2207/02 . External pressure
- F04B 2207/03 . External temperature
- F04B 2207/04 . Settings
 - F04B 2207/041 .. of flow
 - F04B 2207/0411 ... maximum
 - F04B 2207/0412 ... minimum
 - F04B 2207/0413 ... medium
 - F04B 2207/042 .. of pressure
 - F04B 2207/0421 ... maximum
 - F04B 2207/0422 ... minimum
 - F04B 2207/0423 ... medium
 - F04B 2207/043 .. of time
 - F04B 2207/044 .. of the rotational speed of the driving motor
 - F04B 2207/0441 ... maximum
 - F04B 2207/0442 ... minimum
 - F04B 2207/045 .. of the resonant frequency of the unit motor-pump
 - F04B 2207/046 .. of length of piston stroke
 - F04B 2207/047 .. of the nominal power of the driving motor
 - F04B 2207/048 .. of a reference voltage of the driving motor
- F04B 2207/70 . Warnings
 - F04B 2207/701 .. Sound
 - F04B 2207/702 .. Light
 - F04B 2207/703 .. Stopping
 - F04B 2207/704 .. Idling